PAYLOAD 44 - P: SINTERING OF COMPOSITE MATERIALS UNDER REDUCED GRAVITY CONDITIONS

Problem Statement

- The experiment's technology addresses NASA OCT Areas 7 & 12, by demonstrating how the sintering process in reduced gravity can produce high quality materials needed for human settlements on the Moon, and for special ground applications,
- The flight opportunity will provide the reduced gravity conditions needed by the process to obtain highly uniform micro-structures of the sintered materials, starting from sedimentation-free powders.
- Potential users of the technology may be International Space Agencies and private Commercial Organizations and Companies.

Objective of Proposed Experiment

- Objectives of the parabolic flight campaign is to process some pre-compacted samples of simulated lunar soil powders, to be compared with composite materials obtained in 1-g using the same process.
- Expected results are that samples processed at reduced gravity will show a better particle spread and agglomeration, which will improve their thermal & mechanical characteristics.

Proposed Flight Experiment

Test Apparatus Description:

- The test apparatus consists of an induction heater furnace, capable of processing pre-compressed composite material samples in a vacuum chamber according to computer-controlled temperature cycles. Two operators are required for monitoring the cycles and replacing the samples in the chamber.

Experiment Readiness:

- The experiment is ready for flight. The hardware's construction was completed in 2010, and all components and assemblies have been fully tested in 1-g conditions for safety and functionality.

Test Vehicle and Environment:

- The Flight Opportunities' vehicle required for the experiment is the parabolic flight aircraft.
- The experiment hardware has never flown before. In order to test the technology for application to space exploration, the preferred reduced gravity environment is the "lunar" gravity. Additional tests in micro-gravity and "Martian" gravity can be useful as well.

Technology Maturation

- For the current status of its hardware, the experiment has been assessed at TRL 6. The furnace can be considered as a high fidelity prototype of the one intended for materials processing in space.
- Results from the parabolic flights may advance the maturity of the technology to the following levels, involving the construction of a fully automated machine capable of extracting and processing the lunar soil, in order to produce locally the materials to be used by human settlements on the Moon.

Technology Development Team

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- The experiment was developed for the COSMIC Project of the Italian Space Agency (ASI), Viale Liegi, 26, 00198 Rome, Italy.
- No organization that may become partner in this technology development has been identified yet. Cooperation for future developments will be proposed to NASA & ASI after the flight.